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Date 3/20/03 Serial # 10/039,199 Priority Application Date 1/20/02
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 AU 2814 Phone 305-0474 Room 5D26
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03-20-03 P04:20 IN

Where have you searched so far on this case?

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What relevant art have you found so far? Please attach pertinent citations or Information Disclosure Statements.

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Primary Refs _____ Nonpatent Literature _____ Other _____
 Secondary Refs _____ Foreign Patents _____
 Teaching Refs _____

What is the topic, such as the **novelty**, motivation, utility, or other specific facets defining the desired **focus** of this search? Please include the concepts, synonyms, keywords, acronyms, registry numbers, definitions, structures, strategies, and anything else that helps to describe the topic. Please attach a copy of the abstract and pertinent claims.

A buffer film is formed by epitaxially grow a metal film (i.e. In, Ga, B, Al etc metal) and epitaxially grow a metal nitride film (i.e. InN, GaN, BN, AlN). The nitride in the metal nitride layer reacts with the pure metal and form a metal nitride buffer layer.

Look for nitridation, nitrified process.

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Searcher: Derrick Blake
 Searcher Phone: _____
 Searcher Location: STIC-EIC2800, CP4-9C18.
 Date Searcher Picked Up: 3/21/03
 Date Completed: 3/21/03
 Searcher Prep/Rev Time: _____
 Online Time: _____

Type of Search

Structure (#) _____
 Bibliographic ✓
 Litigation _____
 Fulltext _____
 Patent Family _____
 Other _____

Vendors

STN ✓
 Dialog ✓
 Questel/Orbit _____
 Lexis-Nexis _____
 WWW/Internet _____
 Other _____



US 20020197825A1

(19) **United States**(12) **Patent Application Publication** (10) **Pub. No.: US 2002/0197825 A1**

Usui et al.

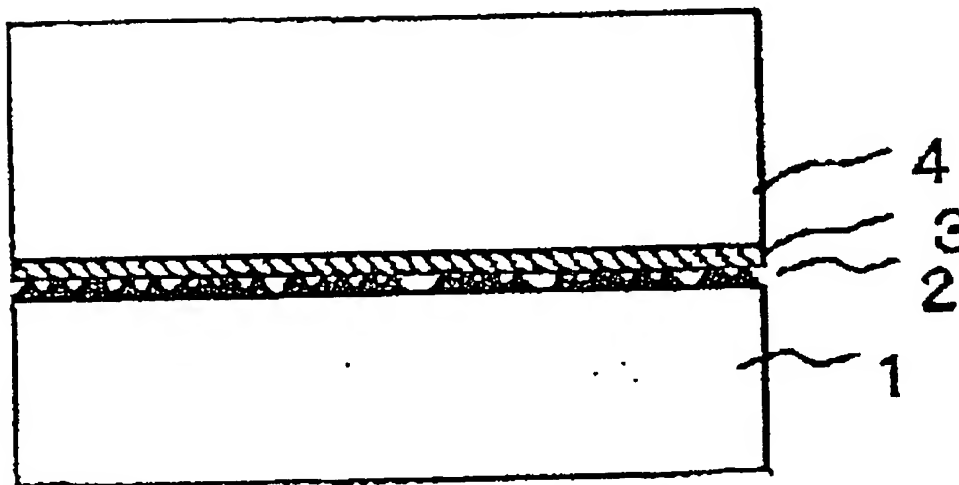
(43) **Pub. Date: Dec. 26, 2002**(54) **SEMICONDUCTOR SUBSTRATE MADE OF GROUP III NITRIDE, AND PROCESS FOR MANUFACTURE THEREOF**

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ARLINGTON, VA 22202(21) Appl. No.: **10/105,404**(22) Filed: **Mar. 26, 2002**(30) **Foreign Application Priority Data**Mar. 27, 2001 (JP) 2001-090148
Oct. 1, 2001 (JP) 2001-305055
Mar. 8, 2002 (JP) 2002-064345**Publication Classification**(51) Int. Cl.⁷ **H01L 31/0328; H01L 31/0336; H01L 31/109; H01L 21/30; H01L 31/072; H01L 21/46; H01L 21/28; H01L 21/3205**
(52) U.S. Cl. **438/459; 438/458; 438/604; 257/189**(57) **ABSTRACT**

To provide a semiconductor substrate of a group III nitride with low defect density and little warp, this invention provides a process comprising such steps of:

forming a GaN layer 2 on a sapphire substrate 1 of the C face ((0001) face); forming a titanium film 3 thereon; heat-treating the substrate in an atmosphere containing hydrogen gas or a gas of a compound containing hydrogen to form voids in the GaN layer 2; and thereafter forming a GaN layer 4 on the GaN layer 2'.



10/039,199

FILE 'REGISTRY'

L1 33 S (IN AND N)/ELS AND 2/ELC.SUB
 L2 46 S (GA AND N)/ELS AND 2/ELC.SUB
 L3 227 S (B AND N)/ELS AND 2/ELC.SUB
 L4 204 S (AL AND N)/ELS AND 2/ELC.SUB
 L5 0 S IN/CN
 L6 0 S INIDIUM/CN
 L7 1 S INDIUM/CN
 L8 1 S GALLIUM/CN
 L9 1 S BORON/CN
 L10 1 S ALUMINIUM/CN

FILE 'HCAPLUS'

L11 5847 S (INDIUM OR IN)(W)(NITRIDE OR N)
 L12 20095 S (GALLIUM OR GA)(W)(NITRIDE OR N)
 L13 24575 S (BORON OR B)(W)(NITRIDE OR N)
 L14 23872 S (ALUMINUM OR AL OR ALUMINIUM)(W)(NITRIDE OR N)
 L15 157167 S INDIUM
 L16 1542518 S GALLIUM OR GA
 L17 187167 S BORON
 L18 1230738 S ALUMINUM OR AL OR ALUMINIUM
 L19 51943 S (L1 OR L2 OR L3 OR L4).
 L20 403401 S (L7 OR L8 OR L9 OR L10)
 L21 6625 S L19 AND L20
 L22 117 S L21 AND EPITAX?(W)GROW?
 L23 17 S L22 AND (BUFFER)(W)(LAYER? OR FILM OR COAT?)
 L24 191 S L21 AND (BUFFER)(W)(LAYER? OR FILM OR COAT?)
 L25 6 S L24 AND (METAL?)(W)(LAYER? OR FILM OR COAT?)
 L26 1 S L22 AND (METAL?)(W)(LAYER? OR FILM OR COAT?)
 L27 271 S L21 AND (METAL?)(W)(LAYER? OR FILM OR COAT?)
 L28 271 S (L24 OR L27) AND METAL?(W)(LAYER? OR FILM OR COAT?)
 L29 6 S L24 AND METAL?(W)(LAYER? OR FILM OR COAT?)
 L30 1 S L22 AND METAL?(W)(LAYER? OR FILM OR COAT?)
 L31 271 S L21 AND METAL?(W)(LAYER? OR FILM OR COAT?)
 L32 7 S L31 AND BUFFER
 L33 18 S L22 AND BUFFER

L34 191 S L24 AND BUFFER
 L35 3 S L24 AND METAL(W)(NITRIDE OR N)
 L36 2 S L22 AND METAL(W)(NITRIDE OR N)
 L37 15 S L27 AND METAL(W)(NITRIDE OR N)
 L38 60335 S ((L11 OR L12 OR L13 OR L14)) AND ((L15 OR
 L16 OR L17 OR L18))
 L39 1615 S L38 AND EPITAX?(W)GROW?
 L40 11 S L39 AND METAL(W)(NITRIDE OR N)
 L41 250 S L39 AND (BUFFER)(W)(LAYER? OR FILM OR
 COAT?)
 L42 99 S L41 AND METAL?
 L43 20 S L41 AND METAL
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 L33 OR L35 OR L36 OR L37 OR L40 OR L43
 L45 67 DUP REMOVE L44 (0 DUPLICATES REMOVED)
 SEL PN
 L46 43 S (EP865088/PN OR FR2571548/PN OR GB2354370/P
 N OR WO2002054468/PN OR AU2001094534/PN OR CN1197998/PN OR
 CN1281247/PN OR CN1289866/PN OR CN1316783/PN OR DE10006108/PN
 OR DE19613265/PN OR EP1039555/PN OR EP1137077/PN OR
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 US2002158258/PN OR US2002187631/PN OR US2003019423/PN OR
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 US6387722/PN OR US6391748/PN OR US6462357/PN OR US6465888/PN
 OR US6492191/PN OR US6504183/PN OR WO2002029873/PN OR
 WO2002040
 599/PN OR WO2002040600/PN OR WO2002067319/PN OR
 WO2003012841/PN
 OR WO9731140/PN)

FILE 'DPCI'

L47 0 S US20020197825/PN.G,PN.D

FILE 'WPIX, JAPIO'

L48 57 S L46
L49 4255 S (INDIUM OR IN)(W)(NITRIDE OR N)
L50 3509 S (GALLIUM OR GA)(W)(NITRIDE OR N)
L51 17485 S (BORON OR B)(W)(NITRIDE OR N)
L52 12257 S (ALUMINUM OR AL OR ALUMINIUM)(W)(NITRIDE
OR N)
L53 25647 S INDIUM
L54 1172436 S GALLIUM OR GA
L55 70900 S BORON
L56 531909 S ALUMINUM OR AL OR ALUMINIUM
L57 21816 S EPITAX?(W) GROW?
L58 13825 S (BUFFER)(W)(LAYER? OR FILM OR COAT?)
L59 106846 S (METAL?)(W)(LAYER? OR FILM OR COAT?)
L60 28495 S ((L49 OR L50 OR L51 OR L52)) AND ((L53 OR
L54 OR L55 OR L56))
L61 325 S L60 AND L57
L62 40 S L61 AND L58
L63 10 S L61 AND L59
L64 317 S (L61 OR L63) NOT L48
L65 317 S (L61 OR L62) NOT L48
L66 317 S L61 NOT L48
L67 317 S L61 NOT L48
L68 46 S (L63 OR L62) NOT L48